

YEAR 9 ADVANCED MATHS, ANALYSIS TASK

Date:	Name: Jasmine Dimmock	Marks: 97%
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NOAH'S ARK

EXCERPTS

Genesis 6: 5 – 22, 7: 1-3

⁵The LORD saw how great the wickedness of the human race had become on the earth, and that every inclination of the thoughts of the **human heart** was **only evil all** the time. ... ⁷So the LORD said, "I will wipe from the face of the earth the human race I have created—and with them the animals, ... ⁸But Noah found favour in the eyes of the LORD.

... ¹³So God said to Noah, ... make yourself an ark of cypress wood; make rooms in it and coat it with pitch inside and out. ¹⁵This is how you are to build it: The ark is to be three hundred cubits long, fifty cubits wide and thirty cubits high. ¹⁶Make a roof for it, leaving below the roof an opening one cubit high all around. Put a door in the side of the ark and make lower, middle and upper decks. ¹⁷I am going to bring floodwaters on the earth to destroy all life under the heavens, every creature that has the breath of life in it. Everything on earth will perish. ¹⁸But I will establish my covenant with you, and you will enter the ark—you and your sons and your wife and your sons' wives with you. ... Take with you seven pairs of every kind of clean animal, a male and its mate, and one pair of every kind of unclean animal, a male and its mate, ³and also seven pairs of every kind of bird, male and female, to keep their various kinds alive throughout the earth.

Question 1

- (a) Write down your own thought about the capacity of this ark to carry "Two of every kind of bird, of every kind of animal and of every kind of creature that moves along the ground".

I don't think they would all fit on the ark ✓

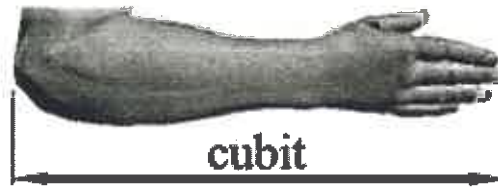
- (b) The picture on the right is a common illustration of Noah's Ark in most media nowadays. Base on the above scripture, comment on if the actual did or did not look like one shown in this picture.

I think it didn't look like that ✓



Question 2 – Units conversion

The length of one cubit was known to be the distance between a man's elbow and fingertip.



Source: http://worldwideflood.org/ark/noahs_cubit/cubit_paper.htm

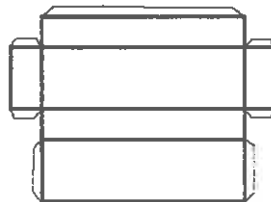
A good estimate of cubits into meters is 1 cubit = 0.45m. Complete the following table showing dimensions of the Ark in different units. Show working out for the conversion from cubit to metre.

	Length	Width	Height
Cubit	300	50	30
Metre	135	22.5	13.5

[3 marks]

Question 3-Total Surface area of the Ark

The diagram in the middle shows a typical net, which could be folded into a 3D cuboid.



2D Net

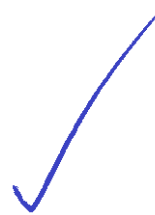


3D Object

- (a) Using the scale of 1:500, draw the net of Noah's ark on a A3 paper. Hint: Convert your original measurements of m into cm first. [3 marks]

Show all working out in space below, and then cut out and make your 3D scaled model (show your model to your teacher before proceeding).

$$\begin{aligned}
 L &= 135\text{m} = \frac{135}{5} = 27\text{cm} \\
 W &= 22.5\text{m} = \frac{22.5}{5} = 4.5\text{cm} \\
 H &= 13.5\text{m} = \frac{13.5}{5} = 2.7\text{cm}
 \end{aligned}$$





(b) The above picture is that of a Titan Big Mac truck carrying a number of carriages. The approximate dimensions of one of the carriages are 10.00m (length) x 2.50m (width) x 3.6m (height) Using the scale of 1:500, draw the net of one of the carriages. Show all working out in the space below, and then cut out and make your 3D scaled model (show model to your teacher before proceeding). Hint: convert your original measurements from m to mm first. [3 marks]

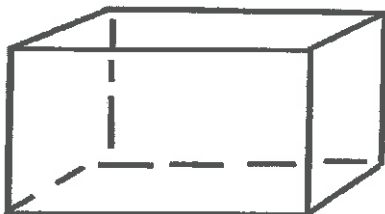
$$L = 10.00\text{m} = 10000\text{mm}$$

$$W = 2.50\text{m} = 2500\text{mm}$$

$$H = 3.6\text{m} = 3600\text{mm}$$



(c) Let h be the height of the ark, l be the length and w be the width. Write an expression representing the total surface area of the ark in terms of h , l and w .



$$2(h \times l) + 2(h \times w) + 2(w \times l)$$



(d) Hence, calculate the total surface area of pitch needed to coat the ark inside and out. Give answer correct to nearest m^2 .

$$2(1822.5) + 2(3037.5) + 2(3037.5)$$

$$3645 + 6075 + 6075 = 10327.5 \times 2$$

$$= 20,655 \text{ m}^2$$

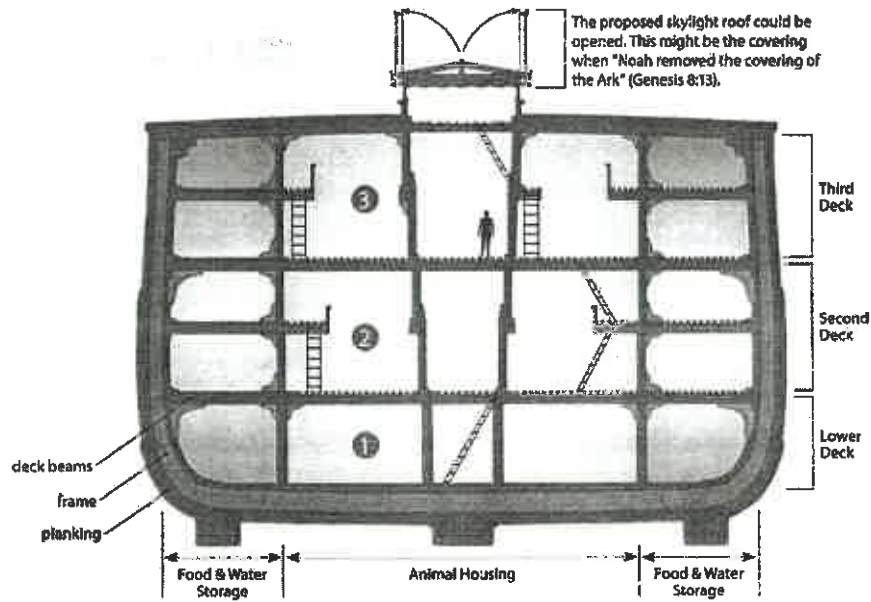


[1+2 = 3 marks]

Optional activity: Measure the actual length and width of Noah's ark in the oval. Students are to stand on the perimeter about 15 metres apart from one to the other (equipment: 4 poles or cones and trundle wheel).

Question 4

This is a cross-section view of a possible design of the interior of the Ark.



Source: <https://answersingenesis.org/noahs-ark/caring-for-the-animals-on-the-ark/>

- (a) Calculate the internal capacity (volume) of the ark. Give answer correct to nearest m^3 .

$$135 \times 22.5 \times 13.5 = 41006.25 m^3$$

(Handwritten scribbles and a circled '1/2')

[1 mark]

- (b) Calculate the "Food and Water Storage" capacity, assuming each side is $\frac{1}{6}$ of the ark's width. Give answer correct to nearest m^3 .

$$\frac{41006.25}{6} \times 2 = 13,668.75 m^3$$

(Handwritten checkmark and circled '1/2')

[1 mark]

- (c) Calculate the capacity of "Animal Housing". Give answer correct to nearest m^3 .

$$41006.25 - 13,668.75 = 27,337.5 m^3$$

(Handwritten checkmark and circled '1/2')

[1 mark]

- (d) Calculate the capacity of "Animal Housing" of one carriage from the road train. Give answer correct to nearest m^3 .

$$10 \times 2.5 \times 3.8 = 90 m^3$$

(Handwritten checkmark)

[1 mark]

- (e) In terms of volume/capacity how many carriages would be able to fit into the ark (show your teacher your answer before proceeding)?

$$455.625 \text{ carriages}$$

(Handwritten checkmark)

[1 mark]

(Handwritten notes: 'ALLOWS 456', '455', 'ALSO')

(f) Complete the following table for the road train carriage.

	Side length	Total surface area	Volume
Paper model	Length 0.02m Width 0.005m Height 0.0072m	0.00056 m ²	0.00000072 m ³
Actual carriage	Length 10.0m Width 2.5m Height 3.6m	140 m ²	20 m ³
Ratio	$\frac{0.02}{10.00} = \frac{0.005}{2.5} = \frac{0.0072}{3.60} = \frac{1}{500}$	0.000004 ✓	0.000000008 ✓

[2 + 2 = 4 marks]

(g) Complete the following table for the ^{ARK} road train carriage.

	Side length	Total surface area	Volume
Paper model	Length 0.27m Width 0.045m Height 0.027m	0.04131 m ²	0.00032805 m ³
Actual Ark	Length 135m Width 22.5m Height 13.5m	10,327.5 m ²	41006.25 m ³
Ratio	$\frac{0.27}{135} = \frac{0.045}{22.5} = \frac{0.027}{13.5} = \frac{1}{500}$	0.000004 ✓	0.000000008 ✓

[2 + 2 = 4 marks]

(h) (i) What do you notice about the relationship between the ratios of the total surface areas with the side length ratios?

The ratio of the total surface area is the side length ratio squared.

(ii) Give the reason for this relationship.

The ratio is the same, but the surface area is using meters squared, therefore squaring the answer.

[1 + 2 = 3 marks]

(i) (i) What do you notice about the relationship between the ratios of the total volumes with the side length ratios?

The ratio of the total volume is the side length ratio cubed.

(ii) Give the reason for this relationship.

The volume is using m³, so while the ratio is the same, the unit of measurement changes the answer to the original answer cubed.

[1 + 2 = 3 marks]

Question 5

(a) The following table shows the average size of some animals. Complete the table

Animal	Height (m)	Length (m)	Width (m)	Volume of the smallest cage that the animal can go in (m ³)
Dinosaur	4.5	2.25	1	10.125m ³
Elephant	3	3	1.3	11.7m ³
Lion	1	2	0.8	1.6m ³
Horse	1.6	2	0.8	2.56m ³
Sheep	1.2	1	0.5	0.6m ³
Dog	0.7	0.7	0.5	0.245m ³
Chicken	0.5	0.5	0.5	0.125m ³
Mouse	0.07	0.2	0.07	0.00098m ³
Lizards	0.07	1.25	0.05	0.004375m ³
Ant	0.01	0.01	0.01	0.000001m ³

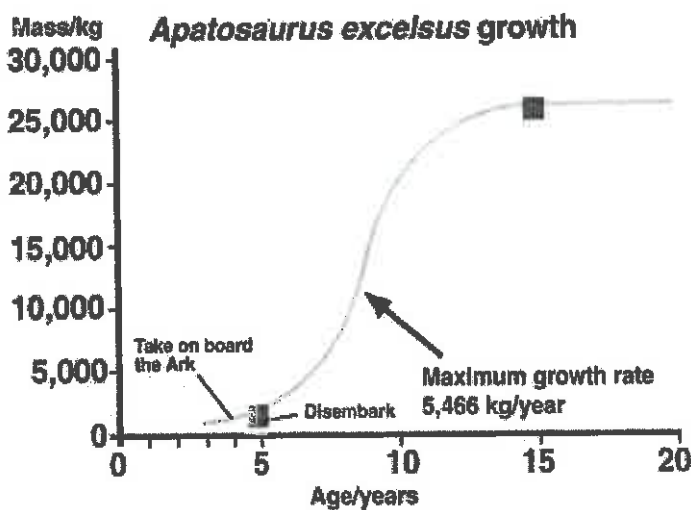
Calculate the average (mean) cage size of the above animals.

= 2.6960356m³

[1 + 2 = 3 marks]

(b) Would it make sense to have fully grown dinosaurs/elephants/giraffes (grandma and grandpa) on board the ark, or younger dinosaurs/elephants/giraffes (refer to the diagram below). Give reason(s) why?

DINOSAUR GROWTH SPURTS



It would make sense to have younger animals on board as they would be smaller and have less mass, making it easier for them to fit in the ark.

<http://creation.com/how-did-dinosaurs-grow-so-big>

[2 marks]

(c) Some scientists, and most creation scientists believe that the average size of all animals on board Noah's Ark would be about the size of a sheep.¹

(i) Using the value you got in question 5(a) for the volume taken up by a sheep (in m³), work out the number of sheep that would fit onto one carriage from the road train.

$$90 \div 0.6 = 150$$



(ii) Calculate the number of sheep that would fit onto 150 carriages.

$$150 \times 150 = 22500$$



(iii) Calculate the number of sheep that could fit into one third of the ark (use your answer from Q 4(b) to help answer, and then get your teacher to check your answer before proceeding).

$$13668.75 \div 0.6 = 22781.25$$

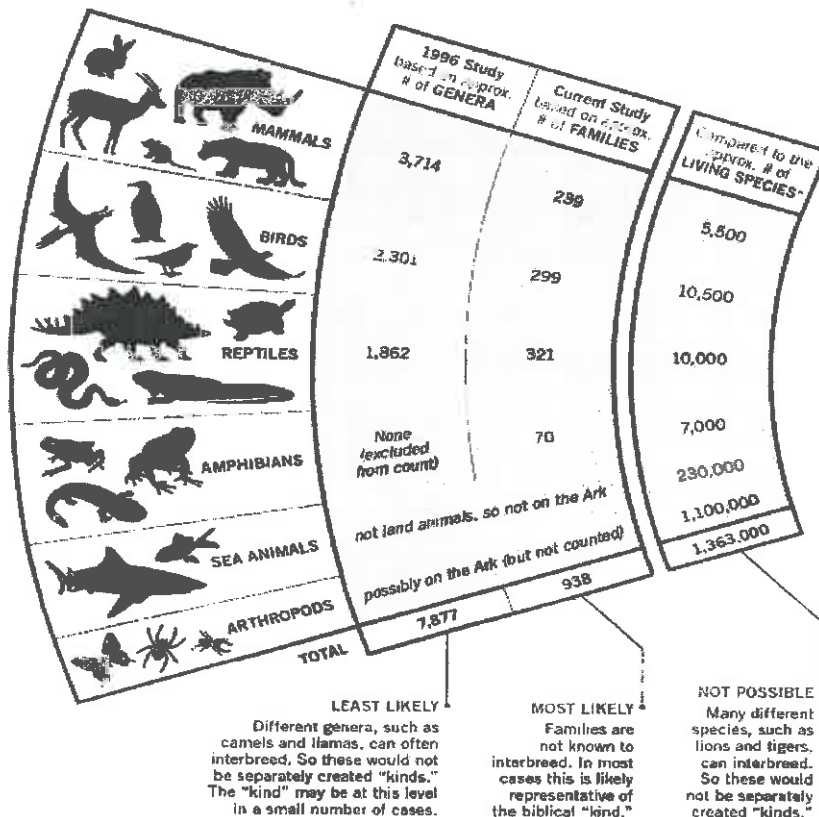
$$= 22,781 \text{ sheep}$$



[1 + 1 + 1 = 3 marks]

(d) Over one million animal species have been named on earth, but it's a mistake to assume all were on the Ark. The Bible says Noah took only air-breathing land animals. So that excludes sea creatures and possibly insects and other invertebrates. Of the land vertebrates, there are only around 33,000 named living species (and a few thousand more fossil species). These are divided into fewer than 10,000 *genera* and 1,000 *families*.

So how many *kinds* of animals were on the Ark? The answer depends on which modern taxonomic level—order, family, genus, or species—represents each original “kind.” A 1996 study assumed the genus, but the new Ark Encounter is evaluating each family.



(i) Would 10,000 "average" sized animals be able to fit onto the ark?

Yes

[1 mark]

(ii) Comment on (i) with respect to the answer you gave in question 1 (a).

I didn't think so many animals would be able to fit, but maths proved me wrong

(c) If a million insect species had to be on board the ark as well, and if each species required cages of 10cm per side, calculate

(i) the volume of one cage (Hint: put your answer in m³).

0.001 m³

(ii) the number of cages that could fit onto one carriage (use your answer from Q 4(d) to help answer).

90,000 cages

(iii) the number of carriages that it would take to fit all the one million insect species (to the nearest whole number).

11 carriages

(iv) how many carriages would it take to fit 1 million insect species and 22,500 "average" sized animals?

11 + 150 = 161 carriages

(v) is this feasible? Explain why or why not (You can use your answers from Q 4(c) and (e) to help explain if you wish).

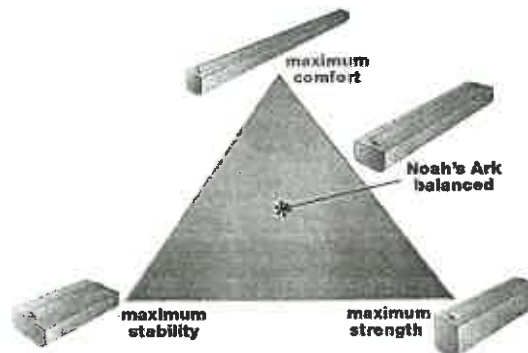
Yes because there is room for a total of 455 carriages on the ark.

[1 + 1 + 1 + 1 + 2 = 5 marks]

Question 6-Safety of Noah's Ark

When designing sea vessels, three main parameters need to be considered.⁴





Sea-keeping quality = is the ride too rough? The longer and taller the ship, the more gentle the ride.	Overturning stability = will it capsize? The narrower the ship, the easier to be capsized.	Structural safety = will it break in half? The longer and shorter the ship, the easier to be broken in half.
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Source: <https://answersingenesis.org/noahs-ark/thinking-outside-the-box/>

You can see that the 3 dimensions - length, width and height - are competing against each other. It is impossible to have the best of each parameter in a single design, but the ark gives the best balance of overall performance.

(a) Complete the following by comparing the ark with other different hull proportions, all **with the same volume**. (4006.25)

Length (m)	Width (m)	Height (m)	Hull front and side view	Description
135	22.5	13.5		Noah's Ark ✓
250	10	16.4		Nice ride, but unstable and weak ✓
68.34	50	12		Hard ride, stable but weak ✓
80	14.65	35		Hard ride, unstable but structurally strong ✓

[6 marks]

Question 7 Comparing Noah's ark to a large modern cargo ship.

Q-Max ship is 345 metres (1,132 ft) long, 53.8 metres (177 ft) wide and 34.7 metres (114 ft) high.



Q-max Mozah

Evaluate the length ratio, width ratio and height ratio of the two boats (to one decimal place, and use the ratio Q-max ship to Noah's ark). Hence, conclude if the two boats are considered to be similar (same shape but different size). Explain why you thought they were or were not similar.

$$345 : 135 = 2.5 : 1$$

$$53.8 : 22.5 = 2.4 : 1$$

$$34.7 : 13.5 = 2.6 : 1$$

I think the two boats were similar in shape because the ratios are almost the same for the three measurements. The shape may be slightly different but overall the same.

[4 marks]

Conclusion

State three things you have learnt from this assignment.

- I learnt how big the ark was
- I learnt a lot of animals can fit into a large space, more than I thought
- I learnt that all the animals could've fit on the ark.

Reference

1. <http://www.christiananswers.net/q-eden/edn-c013.html>
2. <https://creation.com/images/pdfs/cabook/chapter13.pdf>
3. <https://answersingenesis.org/noahs-ark/no-kind-left-behind/>
4. <https://answersingenesis.org/noahs-ark/thinking-outside-the-box/>
5. <http://donaldsona.tripod.com/index-45.html>
6. <http://maritime-connector.com/wiki/ship-sizes/>